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MAY 11 1922

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Technical News Bulletin No. 61

May 10, 1922.

GENERAL NOTE

Owing to the current nature of the investigations mentioned in the Technical News Bulletin, sometimes it will be impossible to supply printed information regarding them. However, in these cases, when the investigation has progressed sufficiently far, the Bureau will be pleased to furnish technical data to those engaged in the particular application of the subject, in order to avoid the delay incident to publication.

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1 Meetings of American Physical Society and Association of Scientific Apparatus Makers at the Bureau of Standards

The 115th regular meeting of the American Physical Society was held at the Bureau of Standards on Friday and Saturday, April 21 and 22, 1922. The Association of Scientific Apparatus Makers also had a meeting at the Bureau on Friday, April 21. Arrangements were made for a joint informal dinner of these two organizations on the evening of that day at which Dr. S. W. Stratton spoke in behalf of the Bureau of Standards, Prof. F. K. Richtmyer for the Association of Apparatus Makers, and Prof. R. A. Millikan as representing the American Physical Society.

At the meeting of the American Physical Society, a large number of very excellent papers were given. Many of these had to do with recent work on x-rays and the structure of the atom, while about 40 papers covered other branches of physics, mainly electricity and radiation. Abstracts of these papers will appear in the Physical Review. The meeting of the society was attended by prominent physicists from all parts of the country, three of them traveling from the Pacific Coast in order to be present and deliver papers.

2 Report of Department of Commerce Conference on Radio Telephony

The conference called by Secretary Hoover to consider the general questions concerning the regulation of radio communication with particular reference to problems involved in the broadcasting of news and entertainment was brought to a satisfactory conclusion on April 19. All suggestions received were given very careful consideration, and the great majority of comments approved the recommendations of the preliminary report which was issued early in March, and as a result the final report, as amended and adopted, was released on April 29, summaries having been published in various newspapers and periodicals.

This report makes recommendations as to the allocation of waves for particular kinds of radio telephone service. It is expected that at an early date a bill will be introduced in Congress which, if passed, will establish the recommendations of the conference as the general law to govern the operation of radio.

3 Publications on Simple Radio Receiving Sets

Letter Circular 43 of the Bureau of Standards described a simple home-made radio receiving set using a crystal detector. This set was of the simplest possible construction and could be made by any amateur for a very moderate price, probably under $10. The demand for this circular was so great that it was decided to print it as a regular publication of the Bureau of Standards, and it is now available from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 5¢ per copy. Persons writing for this material should refer to Circular 120 of the Bureau of Standards.

From letters and inquiries received by the radio laboratory, it was obvious that amateurs were also anxious for a description of a set possessing greater possibilities than the one described above. It has, therefore, been decided to issue a second publication describing a 2-circuit receiving set with variable coupler. This set, of course, has greater selectivity than the single-circuit set and has the great advantage that most of the apparatus used in the first-mentioned outfit may likewise be employed in the new installation. It will be issued as Bureau of Standards Circular No.121 by the Superintendent of Documents for 5¢ a copy. The date of issue cannot yet be given.

4 Revision of Fire Underwriters Requirements for Radio Installation

The National Electrical (Fire) Code embodies the regulations formulated by the National Board of Fire Underwriters to insure the safety of buildings in which electrical installations of any kind have been made.

If these requirements are not met, insurance may be refused entirely or only granted at a much higher rate. Rule 86 of this Code covers the installation of radio equipment and in connection with the general revision of the code now in progress, it has been decided to revise this rule.

Certain tentative requirements have already been drawn up and published in mimeographed form as Letter Circular 62 of the Bureau of Standards. Any one especially interested in this subject may obtain a copy by writing to the Bureau, and suggestions concerning the changes in the code will be gladly received by William S. Boyd, Chairman of the National Fire Protection Association, 175 W. Jackson Boulevard, Chicago, Ill., until September 1, 1922.

5 Detonation in Internal Combustion Engines

For a number of years the Bureau of Standards has cooperated closely with the National Advisory Committee for Aeronautics in investigating the performance of airplane and other types of internal combustion engines. This work has included a study on the phenomenon of detonation, and a paper has recently been prepared on this subject which will appear as Technical Note No. 93 of the National Advisory Committee for Aeronautics. Those desiring copies should write directly to the above-named committee at 2722 Navy Building, Washington, D. C.

The paper is entitled "The Background of Detonation," and has for its object the discussion of a phase of this question which so far has received but little attention. The effect of the temperature and pressure of the charge before combustion is especially considered, as it is believed that a careful study of this "background" can throw considerable light on results that have been obtained in investigations of detonation both at the Bureau and elsewhere.

The circumstances under which detonation occurs are described, and the effects of varying conditions in the engine are discussed. The work of Mr. Harry R. Ricardo in England receives a great deal of attention, and it is believed that additional facts have been deduced from the data which he obtained.

It is shown that compression and explosion pressures, scavenging, and the operation of the ignition system all play a prominent part in the phenomenon of detonation. The influence of changes in fuel characteristics is believed to lie outside the province of this paper and is not taken up in any detail.

Preignition and detonation are conceded to be entirely independent phenomena, and it is shown that overheating troubles are more likely to be from

preignition than from detonation. Curves and diagrams illustrating various phases of the subject are presented, and the whole forms a valuable contribution to the study of the internal combustion engine.

6 Inspection Trip in Connection with Polarimetric Work on Sugar

A member of the polarimetry section of the Bureau spent a day at the Chalmette Refinery of the American Sugar Refining Co. at New Orleans, La., which is one of the most modern refineries in the world. A most unusual and interesting sight seen during the visit was the loading to capacity of a large ocean-going steamship with a cargo of the best grade of granulated sugar. This innovation illustrates in a striking manner the magnitude of the present export business in sugar from the United States. A day was also spent at the new molasses and syrup plant of the Penick and Ford Company. The complete installation for the decolorization of sugar products of carbon and vegetable origin was carefully inspected. A visit was made to the Audubon Park Sugar Experiment Station in New Orleans which is one of the most complete from a cane sugar standpoint of any in existence and is designed primarily for the instruction of students. Students come from all parts of the sugar-producing world to attend the Louisiana Sugar School and after suitable courses at the State University at Baton Rouge, they are transferred to the experiment station mentioned above for the completion of the course. They thus receive unusual practical instruction in the actual growing of sugar cane and in the manufacture of sugar.

7 Meeting of the Sugar Division of the American Chemical Society at Birmingham, Alabama

The meeting of the Sugar Division of the American Chemical Society at Birmingham, Ala., was a most successful one. The attendance was good and represented all phases of the American sugar industry. In all, 18 papers were presented.

The Bureau's work on the determination of color in sugar products by Messrs. H. H. Peters and F. B. Phelps was presented by the former and aroused great interest. Practically an entire day was given over to the presentation of the two papers covering this work. This was done by a special vote of the division.

8 Thermoelectric vs. Photoelectric Reactions in Molybdenite

Some substances, when exposed to light, decrease in electrical resistance. This is commonly called a "photopositive" reaction. About 2 years ago, it was observed in this Bureau that when certain samples of molybdenite are connected with an electric battery and exposed to certain wave lengths of light (blue, green and yellow) the electrical resistance is higher than when the sample is kept in the dark. This is called a

"photonegative" reaction.

At the time when this phenomenon was observed, tests were made to determine whether the molybdenite generated an electric current when exposed to light, without an impressed potential, and it was found that, if there is such a generation of electric current (whether thermoelectric or what might be called a "spontaneous" current), it is too small to affect the above-mentioned photonegative reaction.

Recently, Mr. T. W. Case raised the question whether this photonegative reaction is caused by an electric current, saying he had found that molybdenite is light active, i.e., generates an electric current without an impressed potential. His method of making the test was to explore the illuminated surface (which is sensitive in spots) with fine wire electrodes and a galvanometer or a photophone. Since the thermoelectric power of molybdenite is very high (about 750 M V) the question arises whether by this method of making the test some of the action is thermoelectric.

In view of Mr. Case's query, the photonegative action in molybdenite was reinvestigated. It was found that a small electric current is generated, without any impressed potential, but it is too small to affect the photonegative reaction previously observed.

Concerning the generation of an electric current from light, it may be said that numerous samples of molybdenite were examined, which generated a small electric current without an impressed potential, when exposed to light.

The tests were made by connecting the molybdenite with a sensitive Thomson galvanometer and exposing different parts of the sample to an equal energy spectrum. It was found that, on exposure to radiation, a small electric current is developed which is a function of the wave length of the light stimulus and of the thickness of the sample.

The maximum effect is produced by wave lengths of 0.7 to 0.8μ, and no effect was produced by wave lengths greater than 1μ. The effect may be "photopositive" and "photonegative" depending upon the wave length of the radiation stimulus, just as observed when there is an impressed potential. It is, therefore, an interesting question whether all photoelectrical reactions in solids are an amplification of the effects produced without an impressed emf.

The generation of an electric current directly from exposure of a substance to light (e.g. cuprous oxide in copper formate; probably photochemical) is not an entirely new phenomenon. Whether molybdenite belongs to this class remains to be determined. For in spite of

this apparent selectivity of the reaction to wave length of the light stimulus (which can be explained on the basis of the variation in spectral transmission) some of the effects produced by thermal conduction (heat applied directly by touching the molybdenite with a hot wire) make the phenomenon appear to be thermoelectric, resulting from inhomogeneity and perhaps impurities.

9 Spectrophotoelectrical Sensitivity of Argentite

Work has been completed on a paper covering the spectrophotoelectrical sensitivity of argentite, and it is hoped that it will be published at an early date. This paper, considered in connection with previously published data, represents a study of the effect of crystal structure upon photoelectrical sensitivity as observed in silver sulphide, Ag_2S, in the isometric form, argentite, and in the orthorhombic form, acanthite. The results obtained show that crystal structure affects the spectrophotoelectrical reaction, but it is not the underlying cause of this phenomenon. Silver sulphide appears to have a characteristic response spectrum, just as is true of selenium, cupric oxide, etc.

10 Methods of Analysis of Rubber

A representative of the Bureau attended a meeting of the Committee on Methods of Analysis of the Rubber Division of the American Chemical Society, at Akron, Ohio. The analytical procedure recommended by the Committee and later tentatively adopted by the Division at the Birmingham meeting of the Society is in nearly all respects the same as that in use at the Bureau of Standards. This is very gratifying and is proof of the close cooperation which exists between the Bureau and the scientific organizations throughout the country.

11 Power Loss in Automobile Tires

The rubber laboratory of the Bureau of Standards is equipped with a special dynamometer for determining, among other things, the power loss in automobile tires. A great many of the standard makes of tires have been tested on this dynamometer, and valuable data are being obtained concerning the percentage of the power of an automobile engine which is absorbed by the tires under various conditions.

Some interesting figures have already been secured as a result of this work. For instance, an average 4" fabric tire, under conditions of normal load and air pressure, will absorb approximately .90 h.p. due to rolling resistance at a speed of 25 miles per hour. Under the same conditions, the power loss in a 4" cord tire is approximately .60 h.p., while a 5" cord tire represents a loss of 1.20 h.p. The extent to which

different parts of the tire contribute to the power loss has also been investigated. It is estimated that from 80 to 85% of this loss is in the carcass, the tread contributes 10 to 15%, and the tube probably less than 5%.

12 Durability of Sole Leather Filled with Sulphite Cellulose Extract

The investigation of the durability of sole leather filled with sulphite cellulose extract as compared with sole leather filled with ordinary vegetable tanning materials has been completed. The report on these tests will be issued as a Technologic Paper of the Bureau of Standards and has also been approved for outside publication.

The results show that sulphite cellulose extract is as firmly fixed in the leather as the ordinary vegetable tanning material and that leather filled with it is as durable as leather filled with such materials as chestnut and quebracho.

13 Stucco Investigation

The Bureau of Standards, in cooperation with interested manufacturers, is to carry out an investigation of stucco bases made of woven wire cloth and expanded metal lath. It is expected that 3 types of base now in general use will be applied over sheathed construction, and the performance of the various panels will be noted and analyzed.

14 Durability of Sewer Pipe When Exposed to Alkaline Conditions

Arrangements have been made for a cooperative examination of sewer pipes used in Los Angeles, the work to be conducted by the Bureau of Standards, interested manufacturers, trade associations, and the City Engineer's Office of that city. The object of the work is to discover whether present standard specifications insure a sufficiently high grade and durable pipe to withstand the rather severe alkaline conditions existing in that territory.

A conference was held April 11 at Los Angeles and was attended by 20 representatives of the city, clay and cement interests. An investigational program was discussed and approved at the meeting. Excavations and installations of test sections are now being carried out.

15 New Method for the Analysis of Platinum Ore

Work has been continued on the proposed new method for the analysis of platinum ore. It is felt that one of the most serious objections to methods at present in use lies in dividing the ore into two fractions by means of aqua regia. The Bureau's aim is to avoid this and to remove the iron present in the ore without bringing the ore into solution. It is found that this can be done by first fusing the ore with zinc, disintegrating the zinc obtained with hydrochloric acid and

fusing the residue with potassium pyrosulphate. Although the pyrosulphate fusions were carried out solely to remove iron, it appears that this treatment may have other advantages. It was found that all the rhodium in the ore was taken into solution by the fusion as well as the copper and probably the silver. Experiments conducted on pure iridium indicate that there is a negligible loss of iridium in the sequence of fusions described. Similar experiments are under way with respect to platinum and osmium, and the effect of palladium will also be studied. If successful, this method of treating the ore will be a complete departure from the methods now in use, and the Bureau believes that it will be much more accurate and at least as rapid as present methods.

16 Metallurgical Work on the Platinum Metals and Their Alloys

Pure platinum sponge has been melted, rolled, and drawn to wire which when tested thermoelectrically gives a negative reading of 55 microvolts. This indicates that the wire is purer than the best Heraeus wire in the possession of the Bureau. Such material is prepared by fusing compressed pure sponge in crucibles of specially purified thorium oxide.

Platinum-calcium alloys containing from 0.2 to 2.0% calcium have also been prepared, and their properties are being studied.

A series of tests of various platinum alloys is about to be undertaken to determine suitable specifications for platinum laboratory ware. It is planned to test the ease with which such alloys may be worked, their mechanical properties, structure, and resistance to crystallization on repeated ignitions.

Spectroscopic Analysis of Bronzes

The Bureau has completed the examination of five bronzes for impurities with the purpose of establishing the spectrographic method for quantitative estimation of small amounts of aluminum and silicon which are detrimental in bronze or brass castings. The method is simple, successful, and sufficiently accurate. A report on this practical application of spectrum analysis was presented at the Nonferrous Metals Committee Meeting on April 24.

18 Magnetic Properties of Pure Alloys of Iron and Carbon

Experimental work has been completed by the Bureau of Standards on an investigation of the magnetic properties of a series of very pure alloys of iron and carbon. A number of alloys were prepared having carbon contents ranging from .018 to 1.60% and containing no impurities in sufficient amounts to be of importance. Normal induction and hysteresis data were obtained for magnetizing forces up to 2500 gilberts per cm. and the

results correlated not only with the carbon content but also with heat treatment. The reluctivity relationship previously used in the study of a carbon steel of eutectoid composition was found to be useful in correlating the results. A paper describing the results of this investigation is in preparation.

19 Resistance of Chromium Steels to Acid Corrosion

Tests of the resistance of chromium steels to acid corrosion have recently been completed, and a comparison of the results obtained shows that the relative resistance of a steel to the acid test is not necessarily a criterion of its behavior in other types of corrosion. Pure iron and the steels of low chromium content were found to be much more resistant to attack by hydrochloric acid than those containing considerable chromium. When corroded by water and air, the general order of resistance was reversed. It may be concluded, then, that the addition of chromium increases the rate of attack by hydrochloric and probably by other acids, although this may depend somewhat on the heat treatment which the steel has received. Specimens which had been hardened by suitable heat treatment were found to be considerably more resistant to acid attack than samples of the same composition in the annealed state. The addition of nickel is much more effective in reducing the intensity of the attack by acid than is chromium, since steels containing a considerable amount of this metal were found to be the most resistant to acid of all those tested.

Specimens having a polished surface were found, almost invariably, to show a smaller loss in acid than those which were roughly ground. This difference may be only apparent however, because although the measured surface of 2 specimens may be exactly the same, the one with a "ground" finish has a slightly greater area exposed on account of the minute grooves and ridges which make up the surface than has the polished specimen.

20 The Resistance of Chromium Steels to Atmospheric Corrosion

For resisting corrosion by water and air, a considerable amount of chromium in a steel is necessary, and alloys of this general type were found much more resistant than were those of low chromium content. These latter steels, however, were found much more resistant than the simple carbon steel or "pure" iron. Hardening the chromium steel by heat treatment retarded corrosion by water and air as it did in the acid tests. This was true, in particular, for the steels of high chromium content, while variations in heat treatment produced very little difference in resistance to corrosion in specimens lower in chromium. Adhering patches of oxide

scale upon the surface were found to have a very noticeable effect in accelerating the rate of attack of the chromium steels.

The alloy containing a high percentage of nickel, as well as chromium, found to be attacked the least by acid, also proved much more resistant to atmospheric corrosion than most of the chromium steels tested although it was far surpassed by certain of the high chromium materials.

In most cases corrosion of the chromium steels consisted in an attack at small isolated spots rather than in a general tarnishing and coating of the surface. This, in view of the fact that adhering particles of scale accelerate the corrosive attack of a steel to a very marked degree, suggests that the presence of inclusions or other defects within the material may be responsible in large measure for the character of the resulting surface pattern.

The character of the service should govern the type of "non-corrodible" steel to use. For example, if resistance to severe acid attack is the principal requirement, a high chromium steel is the least suitable of all the materials tested. However, most classes of service require fairly satisfactory performance under a variety of conditions. Thus, for example, cutlery steel must withstand both acid and atmospheric corrosion as well as possess certain necessary mechanical properties, "forgeability," hardness, etc. No single type of non-corrodible steel appears to be suitable for each and every purpose which may arise.

21 Thermal Stresses in Chilled Iron Car Wheels

The investigational work which the Bureau of Standards has conducted on thermal stresses in chilled iron car wheels has been previously mentioned in the Bulletin. Technologic Paper No. 209 on this subject may be obtained from the Superintendent of Documents, Government Printing Office, this city, at 5¢ per copy.

The subject is introduced by stating that for more than half a century over half the freight cars in this country have been equipped with chilled iron car wheels. It is pointed out that in spite of the fact that these chilled iron wheels have been eminently satisfactory, even under the strenuous service conditions of today, accidents have occasionally occurred, particularly on roads having long mountainous grades where prolonged brake application results in excessive heating of the tread of the wheel.

The method of manufacturing wheels of this sort is described, and the paper then takes up the laboratory tests developed by the Bureau and which duplicate the severest possible thermal stresses to which such wheels

may be subjected. The wheels were heated by passing an electric current through a band of iron encircling the wheel but electrically insulated from it, and the resulting stresses were calculated from strain-gage measurements after correcting for thermal expansion.

Twenty-eight wheels of varying weights and design from three manufacturers were tested of which 16 failed by cracking in the plate. Although the total number of wheels tested is too small to draw any definite conclusions, the results seem to point to the following generalities which should be confirmed by a greater number of tests:

(1) The maximum stresses developed are very close to the tensile strength of the cast iron and are some function of the strength of the iron.

(2) The maximum tensile stresses occur in a radial direction near the junction of the double plates in the M. C. B. or Washburn type of wheel. In the arch plate type, the maximum stress is somewhat nearer the hub which seems to be a desirable condition in that the stress lies in the region where it is counteracted by the stress caused by forcing the wheel on its axle.

(3) The stress in a tangential direction on the outer face and also the stress in both the radial and tangential directions on the bracket side of the wheel are relatively small when compared to those in a radial direction on the outer face of the wheel.

(4) By proper distribution of metal in the single plate type of wheel, there would appear to be a possibility of securing a wheel more capable of meeting service requirements.

(5) With identical rates of heat input, the heavier weight wheels withstand the effect of tread heating with less strain than the lighter wheels.

(6) The tests also indicate that the operating conditions to which wheels are subjected may be as important a factor in the safety of the wheel as are the problems arising in their manufacture.

22 Specifications for Glass Tableware

During the month, the Bureau was able to apply the tests which are now required in tumbler specifications to samples of the entire line of glass tableware of one large retail dealer. It would appear that these tests will adequately separate glass which will break too easily from glass of acceptable durability. However, additional evidence, which is being accumulated, will make possible the preparation of broader specifications.

23 Standardization of Sash and Window Openings

A representative of the Bureau attended the convention of the American Federation of Construction Industries, with the object of discussing the matter of standardizing sash and window openings. Mr. Brown of

the Small House Service Bureau and Mr. Godfrey of the Western Sash and Door Association were specially interviewed on the subject. Arrangements were made for collecting samples and some were obtained during the trip. Other persons interviewed regarding the work now under way were Mr. Storms, Secretary of the Glass Distributor Association, Dr. A. W. Bitting, Director of Research, Glass Container Association of America, Mr. Glenn M. Hobbs, Sears-Roebuck and Company, Mr. Owens and Mr. Cochrane of the Owens Bottle Company, Mr. Root and Mr. Fowler of the Libbey Owens Sheet Glass Company, and Messrs. Currant and Rowe of the American Bottle Company.

24 Specifications for Lubricating Oils

A member of the Bureau's staff attended a meeting of the Lubricating Oils Division of the Society of Automotive Engineers at Chicago, on April 18. Some of the delegates wished to have viscosity specified at only 100°F, while others wanted it at 210 and 300°F. The compromise agreement finally reached was to specify viscosity at 100 and 210°F. The proposal to insert an emulsion test in the specifications failed by a small margin. Organic acidity was placed at 0.15 as a compromise between certain oils in the government specifications with acidity of 0.10 and others with 0.3.

25 Specifications for Refractories

At the last meeting of the advisory committee on specifications for refractories, it became evident that additional investigation would be necessary to determine what test requirements are most effective in drawing the line between satisfactory and unsatisfactory brick for furnace linings in stoker fired boilers. As a result preparations are being made to conduct an extended series of tests, including a 72-hour reheating test at 1450°C. A prominent consulting engineer is cooperating with the Bureau in this work and in addition to gathering information as to the suitability of different brands of brick, is arranging to have a quantity of samples representing about 20 brands shipped to the Bureau of Standards by the users.

PUBLICATIONS OF THE BUREAU OF STANDARDS RELEASED DURING APRIL.

Scientific Papers

S 428 Radio direction finder and its application to navigation. F. A. Kolster and F. W. Dunmore. 15¢

S 429 Note on the preparation of Mannose. E. P. Clark 5¢

Technologic Papers

T 207 Manufacture and properties of steel plates containing zirconium and other elements. G. K. Burgess and R. W. Woodward. 20¢

T 208 Weighing by substitution. C. A. Briggs and E. D. Gordon. 5¢

Circulars

C 119 Specifications for lime-flint glass tumblers. 5¢

These publications may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., at the prices given above.

Respectfully,

S. W. STRATTON

Director
HGB